

REMARKS

Reconsideration and allowance in view of the foregoing amendments and the following remarks is respectfully requested.

Claims 1-22 are pending. Claims 1, 3, 5, 6, 9, 11, 15, 17, 18 and 21 are amended for clarification.

Claims 1-2 and 19-20 were rejected under U.S.C.103(a) as being unpatentable over Le Tallec et al. (US patent 6,438,492) in view of Tran et al. (US patent 5,892,462) and Kelly et al. (US patent 6,567,728). Applicants traverse this objection for reasons discussed below.

The present invention relates to terrain anticollision equipment onboard an aircraft known as TAWS equipment. Generally, TAWS equipment produce alarms of risk of collision with each intrusion of the relief and/or ground obstacle overflow in one or more protected volume around the current position and the current trajectory of the aircraft. Some propose an appropriate terrain avoiding maneuver each time they produce an alarm.

When the TAWS equipment onboard an aircraft produces an alarm of risk of collision with the terrain, the pilot of the aircraft executes an appropriate avoidance maneuver (generally a pull-up maneuver) that diverts the aircraft from the route of its flight plan. The pilot must wait to be appreciably above the safety altitude fixed for the zone being flown over before thinking to rejoin the route of the flight plan. An aim of the present invention is to give a clear indication of the instant from which a pilot can end a terrain avoiding maneuver to rejoin the route of his flight plan.

The present invention as defined in claim 1 is directed to a terrain anticollision equipment on board an aircraft, which includes:

- means for determining a virtual envelope of protection maneuver around the current trajectory of the aircraft,
- means for detecting intrusions, into said virtual envelope of protection of maneuver, of a representation of an envelope of the terrain and/or of the ground obstacles overflow stored in a data base, and

- alarm means for alerting of a risk of terrain collision, triggered by the intrusion detection means each time said detection means detect a terrain and/or ground obstacle intrusion in the virtual envelope of protection maneuver.

In order to give an indication of the possibility of ending a terrain avoidance maneuver,

- the means for determining virtual envelope of protection determines, in addition to the virtual envelope of protection of maneuver, determines other virtual envelope of protection of resumption route constructed around a fictitious trajectory of resumption route,

- the means for intrusion detection detects the intrusions of the terrain and/or of the ground obstacle at one and the same time into the virtual envelope of protection of maneuver and into the virtual envelope of resumption of route, and

- the alarm means produces an indication signaling the possibility of ending an avoidance maneuver as soon as the means of intrusion detection no longer notes any intrusion of the terrain and/or of the ground obstacles into the virtual envelope of protection of resumption of route.

Le Tallec et al. do not disclose a terrain anticollision equipment to be carried onboard an aircraft but an aircraft anticollision system to be carried onboard an aircraft to alert an aircraft pilot of potential risks of collision with other aircraft (col. 2, lines 55-57). Le Tallec et al. teaches to exchange, between aircraft flying in the same neighborhood, position and speed vectors by means of co-operation messages and to identify the collision risk for one aircraft with an other cooperative aircraft, to the intrusion in a protected volume around the aircraft of the estimate of possible positions of the other aircraft. Le Tallec et al. does not disclose or suggest detecting the intrusion of the terrain and/or of the ground obstacles in a protected volume around the aircraft.

Tran et al. disclose a terrain anticollision equipment implementing (col. 6, line 42-44): firstly, a predicted ground collision procedure for detecting a terrain collision situation, and secondly, when a terrain collision situation is detected by means of the predicted ground collision procedure, a predicted ground avoidance procedure for determining an initiation of ground avoidance point (col.7, line 7-14) and an appropriate

flight path avoiding a terrain collision situation (col. 13, line 55 to col. 14, line 17).

The first predicted ground collision procedure uses a first virtual envelope of protection of maneuver based upon an extended current flight trajectory and the possible maneuvers that a pilot is likely to carry out (col. 5, lines 33-40) and calculated by a first predicted flight path system (52 figure 9) to predict ground collision and give a forward-in-time ground collision situation (col. 10, lines 25-37).

The second predicted ground avoidance procedure is iterative and uses a second virtual envelope of protection based upon the current dynamic state of the aircraft, dynamic constraints and the probable aircraft recovery maneuver (col. 8, lines 19-24) and calculated by a second predicted flight path system (54 figure 9) to provide a check if a ground collision is truly imminent and, when it is determined that the climb out path is no longer possible, an evasive maneuver is provided based on flight path recalculations (col. 10, lines 51-64).

This second virtual envelope of protection is a virtual envelope of protection of evasive path for solving a terrain collision situation. It does not give any information concerning the resumption of the route followed before the detection of a ground collision situation.

Kelly et al. discloses a terrain awareness system having a nuisance alarm filter suppressing TAWS alarm (warning indicating to the pilots that they are in danger of ground collision) during the approach of a airport runway equipped with an ILS (Instrument landing system with localizer and glide slope components) when the aircraft is properly aligned for landing in the glideslope and localizer beams of the ILS equipment (col. 3, lines 42-50).

Kelly et al. does not signal the possibility of ending an avoidance maneuver of the ground but suppress any false TAWS alarm during a proper approach of an airport runway for landing. With the false TAWS alarms being suppressed, the alarms cannot be heard by the pilots and so do not have any reason to make a terrain avoidance maneuver. It can be noted that the ILS equipment that is an essential part of Kelly's TAWS equipment has no counterpart in the equipment defined in the claim 1 of the present application.

Le Tallec, Tran and Kelly fail to disclose or suggest equipment with all the features of the independent claim 1 in the present patent application.

Concerning claim 2 of the present application, Le Tallec et al. does not disclose (col. 5, lines 52-56) any horizontal trajectory for a fictitious trajectory of resumption of route. Le Tallec et al. only disclose the use of the instantaneous turning radius R of an aircraft in the horizontal plane in combination with the three volume position coordinates x, y, z and the three volumes projections V_x, V_y, V_z of the velocity vector V of this aircraft for predicting different possible future positions of this aircraft (see col. 7, line 23 to col.8, line 22, especially col.8, lines 13-19).

Concerning claim 19 of our application, as mentioned before, Le Tallec does not describe a terrain anticollision equipment but a system for avoiding collision between flying aircraft and Kelly does not disclose the indication signaling the possibility of ending an avoidance maneuver but the suppression of a false TAWS alarm when the aircraft is properly aligned for landing in the glideslope and localizer beams of an ILS equipment. So the teachings of Le Tallec and Kelly cannot make obvious, to one of ordinary skill in the art, an equipment with all the features of the independent claim 1 and dependant claim 19.

Concerning claim 20, as previously mentioned, Kelly discloses a TAWS equipment with suppression of terrain collision alarm when the aircraft is properly aligned for landing in the glideslope and localizer beams of an ILS equipment. Kelly does not suggest to produce an indication of holding of the avoidance maneuver in aural and/or visual form, upon the disappearance of a terrain alert and does so, until no risk of collision is detected by the virtual envelope of protection of resumption of route. Accordingly, claims 1-2 and 19-20 are patentable over the applied references and the obviousness rejection should be withdrawn.

Claim 3 is rejected under 35 USC103(a) as being unpatentable over Le Tallec et al., Tran et al. and Kelly et al. as applied to claim 1 and further in view of Ishihara et al. (U.S. patent 6,906,641).

Ishihara et al. disclose a terrain anticollision equipment for helicopter using virtual envelopes of protection (alert envelopes) with cut-off boundaries depending of the flight

condition of the helicopter (climbing, holding or descending) before any alert of risk of terrain collision. They do not concern a resumption route for a helicopter after a terrain avoiding maneuver.

Further, it is difficult to believe that an equipment requiring to be planned the help of the teachings of four patents, two of which having more than twenty pages, can be considered as obvious.

Claims 4-8 and 21 are rejected under 35 USC103(a) as being unpatentable over Le Tallec et al., Tran et al. and Kelly et al. as applied to claim 1 and further in view of Bateman et al. (U.S. patent 4,567,483). Applicants respectfully traverses this rejection.

Bateman et al. disclose a ground proximity warning system for aircraft using warning criteria or warning envelopes on the flight parameters as: sinkrate of the aircraft with respect of the barometric altitude (mode 1), barometric altitude loss with respect of altitude (mode 3), aircraft airspeed with respect of the altitude (mode 4A,4B), etc.. Bateman teaches to vary warning criteria when the aircraft is in a predetermined warning location. Bateman's teaching does not concern a resumption route after a terrain avoiding maneuver following a warning of risk of terrain collision. So adding the teaching of Bateman et al. to the teachings of Le Tallec, Tran and Kelly cannot make obvious to one of ordinary skill in the art an equipment with all the features of the independent claim 1 and dependant claims 4-8 and 21.

Concerning claim 4, Bateman et al. do not teach or suggest adopting a trajectory having as slope a slope dependent on the instantaneous trajectory of the aircraft as a fictitious trajectory of resumption of route. The preceding remark is applicable concerning Bateman et al with regard to claims 5-8..

Concerning claim 21, Bateman et al. disclose a ground proximity warning system that does not use any virtual volume (envelope) of protection of maneuver (around the aircraft) but that uses warning envelope on flight parameters. So Bateman suggests adopting the vertical distance under the aircraft at which a virtual envelope of protection of resumption of route equal to that used for one of the virtual envelopes of protection of maneuver. Accordingly, the obviousness rejection of claims 4-8 and 21 should be withdrawn.

Claim 22 is rejected under 35 USC103(a) as being unpatentable over Le Tallec et al., Tran et al., Kelly et al. and Bateman et al. as applied to claim 1 and further in view of Snyder et al. (U.S. patent 6,922,703). Applicant respectfully traverses this rejection.

Snyder et al. describe a system to display a layered map with active flight plan as the focal point of representation and with indications of geographic areas that are potential threats to the aircraft. But this display system is not concerned with virtual envelope of protection of resumption of route. So Snyder et al. cannot suggest taking consistent the vertical distance under the aircraft at which a virtual envelope of protection of resumption of route is placed with that used on the screen for the representation of the terrain layers and/or of risk with the terrain and/or the obstacles overflown.

Adding the teaching of Snyder to the teachings of Le Tallec, Tran, Kelly and Bateman cannot make obvious to one of ordinary skill in the art equipment with all the features of the independent claim 1 and dependant claim 22.

To resume, no one of the patents of Le Tallec, Tran, Kelly, Ishihara, Bateman or Snyder are concerned by a resumption route for an aircraft after a terrain avoiding maneuver following a warning of risk of terrain collision. So these patents considered alone or in combination cannot suggest or make obvious an equipment with the features of claims of our patent. Accordingly, the obviousness rejection should be withdrawn.

All objections and rejections having been addressed, it is respectfully submitted that the present application should be in condition for allowance and a Notice to that effect is earnestly solicited.

Early issuance of a Notice of Allowance is courteously solicited.

The Examiner is invited to telephone the undersigned, Applicant's attorney of record, to facilitate advancement of the present application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,

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Date: July 19, 2007
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